

From the Ophthalmological Clinic of the University of Zurich

Director: Prof. Dr. Marc Amsler

(Thesis prepared under the guidance of Dr. med. H. R. Böhlinger, SR. Resident)

**A Statistical Survey of the Noncongenital
Blindness observed at the Zurich
Ophthalmological Clinic from 1945 to 1953**

INAUGURAL-DISSERTATION

**for the Degree of Doctor of Medicine from the Medical Faculty
of the University of Zurich**

presented by

Frederick N. Fischer

of Berkeley, California / U.S.A.

Accepted on the proposal of Prof. Dr. Marc Amsler

Juris - Verlag Zttrich

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Introduction

The purpose of this article is not only to show statistically the causes of blindness occurred at the Zürich ophthalmological clinic, but also to give a critical survey of the possibilities and results of therapy applied.

Because of the great differences in visual limits of the blind, vision of less than 3/60 in each eye was arbitrarily chosen for this article.

This investigation included all patients hospitalized in the Zürich ophthalmological clinic from January 1, 1945 until June 30, 1953. In these 8½ years 6000 patients have been admitted and patients with repeated admissions were counted only once.

Outpatients were not received because either they were blind previous to 1945 or they were not considered serious enough to be admitted for treatment in the clinic.

In order to keep the causes relative for Switzerland, patients coming from outside of Switzerland for treatment were not considered.

Congenital abnormalities (congenital cataract, hydrophthalmos, etc.) were not included even though cases such as tapetoretinal degeneration lead to blindness in later years. On the other hand it was necessary to include several cases of congenital eye diseases since they had a secondary factor leading to blindness.

Included in this report are those patients by which, despite all therapeutical measures, the doctors' and patients' hopes for saving or reconstructing the sight were abandoned.

Indications for the improvement or further development of the prophylaxis, medication and operative therapy could be derived from this survey.

In tabulating the cases, those patients having two etiological factors lead to blindness were listed under the factor which caused the final blindness.

It should be noted that for the majority of the cases the loss of sight was more or less sudden. Age was an important element, especially in the cases of degenerative and metabolic processes. Of particular importance under this group were diabetes, arteriosclerosis, degenerative processes of the retina, optic nerve and glaucoma.

The arrangement of the various factors of blindness into a unified pattern is extremely difficult. A suggestion that factors of blindness be divided into separate etiological and localisatory units, for the purpose of statistics, was advocated by C. Berens, A. E. Kirby and F. Foote. This presented a rather complicated picture.

A simplified classification was attempted for this article. Primarily, the etiological factors were considered and secondarily, an arrangement according to the localization from the cornea to the higher optical centers was used.

The following is a tabulary summary of the cases involved in this survey:

I.	Injuries		15
	A. Chemical burns		5
	1. Ca(OH)_2	2	
	2. NaOH	3	
	B. Traumatic		10
	1. perforation of both eyes	5	
	2. contusion		
	a. of both eyes	1	
	b. of only eye	4	
II.	Infections		28
	A. Keratitis		7
	1. interstitial, syphilitic	3	
	2. gonococcal ophthalmia neonatorum	1	
	3. herpetic	1	
	4. hypopyonkeratitis	1	
	5. unclassified	1	
	B. Chronic uveitis and iridocyclitis		16
	1. Still-Chaufford syndrome	2	
	2. chronic adult uveitis and iridocyclitis		
	a. tuberculosis	4(5)	
	b. rheumatic	2	
	c. non classified	8(7)	
	C. Infectious retino-vascular diseases		5
	1. typical tuberculous periphlebitis	2	
	2. septic-embolic obstruction of the branches of the retinal arteries	3	
III.	Metabolic and degenerative processes		75
	A. Diabetic retinopathy and complications		11
	B. Arteriosclerosis		12
	1. arteriosclerotic retinopathy	3	
	2. obstruction of the central retinal artery	2	
	3. thrombosis of the central retinal vein	1	
	4. arteriosclerotic atrophy of the optic nerve	4	
	5. cerebral arteriosclerosis	2	
	C. Atrophy of the optic nerve		4
	D. Cataract		6
	1. pre-senile	3	
	2. post operative complications of senile cataract	3	
	E. Myopic degeneration of the retina		1
	F. Detachment of the retina		17
	1. idiopathic	13	
	2. aphacic	4	
	G. Glaucoma		22
	1. chronic simple	16	
	2. chronic inflammatory (congestive)	6	
	H. Secondary glaucoma		2

IV. Tumors		4
A. Retinoblastoma	1	
B. Brain tumors	3	
	Total	122
		=====

Data

I. INJURIES

The causes of injury to the eye were placed in two main categories, chemical and mechanical.

A. CHEMICAL BURNS

There were three cases of calcium hydrate burns and two cases of sodium hydroxide burns.

The source of the calcium hydrate burns is identical in all three cases. The patients were farmers who were careless while white washing their barns with plant type sprayers filled with Ca(OH)_2 . The apparatuses were easily clogged by the undissolved lime. The person maneuvering the sprayer in each case removed the nozzle while the apparatus was still under pressure. The impending result was an explosion, which strew calcium hydrate into the eyes of the person operating the instrument.

The wearing of protective goggles, thoroughly dissolving the lime, making sure that no pressure remains in the system before removing the nozzle and using a modern instrument specifically constructed for this work would prevent the above accidents. (J. Strebel.)

The two sodium hydroxide burns were very interesting since both cases were the results of viscous attacks. The first case was the result of an unknown assailant. The second was the result of an argument between the patient, a painter, and his second (or third) wife who, during a moment of rage, splashed NaOH in his face.

There were four male patients 38, 42, 43 and 61 years old when the accidents happened. The woman, a farmer's wife, was 52 years old at the time of the mishap.

Almost immediate first aid was applied in all cases by irrigating the eyes with a weak neutralizing solution, physiological saline and administering intensive vaso-dilator therapy. A Denig plastic operation was performed on both eyes of one patient and on one eye each of two other patients. The emergency operation did not avoid the ensuing vascularization and thickening of the cornea. Keratectomys were performed twice on one eye of two patients; a corneal graft was performed on one eye of one of these patients and on both eyes of the other patient. Secondary glaucomas followed the operations on the above two patients. One patient received a keratectomy and in performing a corneal graft the lens was expelled yielding a prolapse of the vitreous body which altered the results. Three keratectomys and four corneal grafts on the same eye of one patient were without success.

The thickening, cloudiness and vascularization of the cornea in all cases presented a questionable prognosis for further corneal grafts.

B. MECHANICAL INJURIES

There were 10 cases of mechanical injury to the eye. Five cases were the results of simultaneous perforation of both eyes. Five patients, each with only one eye, were the victims of contusions.

1. Perforations

The five patients were male and between the ages of 17 and 32 when the accident occurred.

The causes of the perforations were manifold. One case was caused by the backfiring of a gun during local sham battle between defense units. Another case was caused by dynamite caps exploding in the hands of the patient. Black powder exploded in an unprotected glass tube, blinding a young chemist. A blast resulted in the perforation of one patient's eyes. The last case was the result of a chip of wood loosened while being turned on a lathe.

Therapeutically, all five cases were somewhat similar in that it was necessary to enucleate one eye primarily. In three cases the remaining eye became hypotensive and it was essential to enucleate one of these eyes. In the case of the chemist, the second eye, with traumatic aphacia, was considered out of danger and functioned with a fair degree of satisfaction when, three years later, a retinal detachment practically eliminated the remaining sight. An attempted operation on the retinal detachment was unsuccessful. The fifth case developed a late iridocyclitis which

resulted in chalky deposits in a cataract and chalcosis of the cornea. The vision dropped to 1/60 and remained stable after a preparatory iridectomy. It is hoped, in this case, eventually to aid the vision.

No sympathetic ophthalmias developed in the cases of perforations. (See senile cataracts with post operative complications.)

2. Contusion of the eyeball

All five patients were male and were 28, 44, 45, 53 and 75 years old when a contusion ended in the loss of sight.

Common to every case was the loss of one eye due to previous traumas. The traumas were listed as two cowhorn perforations, an arrow wound, two unknown perforations, and one contusion.

The first case developed a subluxated lense, a hypermature cataract and the iris atrophied. The lense was extracted and a post operative exsudation led to phthisis making it necessary to enucleate the eye. A detachment of the retina followed by a secondary glaucoma made it necessary to enucleate the eye of the second case. With a subluxated lense, a retinal detachment and a prolapse of the vitreous body, the third patient became blind. The fourth case actually received two traumas, the first causing a cataract and the second, a contusion of the frontal bone, resulted in a detachment of the retina. A contusion of the side of the face and forehead of the fifth case, resulted in a detachment of the retina and a traumatic cataract developed later.

Operations for the retinal detachments were performed once in the third case, three times in the fourth case and twice in the fifth case. In the first, third, and fourth cases, the cataracts were removed. A post operative exsudation altered the results of the first case, the remaining showed no improvement due to the retinal detachments. Two lamellar sclerectomies were performed in the fourth case, all other operations for retinal detachments were either surface diathermias or catholysis.

II. INFECTIONS

A. KERATITIS

There were three cases of syphilitic interstitial keratitis, one herpetic keratitis, one hypopyonkeratitis, and one case each of gonococcal ophthalmia neonatorum and non classified keratitis.

1. Interstitial, syphilitic

The three cases concerned elderly men and ran courses of more than forty years. Common to two cases was the problem of secondary glaucoma and iridocyclitis. The third case demonstrated a corneal degeneration and the typical iridocyclitis.

a. W. P., male, born 1887 (No. 2447). After iritis and syphilitic interstitial keratitis in 1907, an absolute glaucoma of the left eye necessitated its enucleation in 1942. A secondary glaucoma of the right eye was treated with cyclodiathermy and in 1950 an iridocyclitis made it essential to remove the eye.

b. E. H., male, born 1884 (No. 4663). In 1900 the patient was treated for syphilitic interstitial keratitis. In 1926/27 a secondary glaucoma of both eyes was diagnosed and four operations on the right eye and two operations on the left eye were performed. In 1942 the VR was hand movement and in 1944 an acute attack of iridocyclitis reduced the left vision to 1/60. After a complicated cataract was extracted in 1951 the VL climbed to 0, 1. Phthisis bulbi of the left eye developed in 1952. Both eyes demonstrated corneal dystrophias.

c. P. G., male, born 1881 (No. 101). The keratitis was first treated in 1935. After iridocyclitis a corneal degeneration developed and in 1945 a vision of light perception in both eyes remained.

2. The case of the gonococcal ophthalmia neonatorum, V. G., male, born 1905 (No. 4469), was relatively precluded. The patient lost his left eye at the age of seven. In 1951 the patient demonstrated a severe adherent leucoma with an anterior and posterior polar cataract. The cataract was extracted and the result was a vision of 2/60 in the right eye.

3. In the case of the herpetic keratitis, H. V., male, born 1890 (No. 3217), an intraocular foreign body precipitated the loss of the left eye in 1913. In 1944/45 a creeping ulcer led to a secondary glaucoma and a complicated cataract. Two antiglaucomatous operations, three corneal grafts and the extraction of the cataract were unsuccessful in increasing the vision above 1/60.

4. The case of the hypopyonkeratitis actually was a case of double etiological factors. J. L., male, born 1879 (No. 3879). The left eye was blind due to an untreated simple congestive glaucoma. In 1950 a herpetic keratitis reduced the vision to 0, 1. A lamellar corneal graft was performed but the vision dropped to 2/60 and in 1951 the patient succumbed after an apoplectic insult.

5. A. B., female, born 1918 (No. 3018), is a case of unclassified keratitis. In 1925 the patient contacted a keratitis of her left eye. A secondary glaucoma developed

and in 1941 it was necessary to enucleate this eye. In 1948 the right cornea became inflamed, totally clouded and vascularized. A chronic iridocyclitis further complicated the picture. In 1948 an iridectomy, in 1949 a perforating corneal graft were performed. The graft became dystrophic and in 1950 a lamellar keratoplasty was performed but this too became dystrophic. No further attempts were made and the vision remained at hand movement before the eye.

B. CHRONIC UVEITIS AND IRIDOCYCLITIS

The cases of chronic uveitis and iridocyclitis were divided into the Still-Chauffords syndrome of children and the chronic uveitis of adults. The adult group was divided into those with tuberculosis or questionable tuberculosis, rheumatic and the non classified etiological factors.

1. The two cases of Still-Chauffords syndrome of children presented the typical clinical symptoms of band-shaped corneal degeneration, chronic uveitis and complicated cataract. In the second case the usual rheumatic signs were absent.

a. K.D., male, born 1944 (No.4420). In 1951 a preparatory indectomy was performed on both eyes after the iridocyclitis caused complicated cataracts to be formed in both eyes. With a hypotension in both eyes, further operative therapy was deemed too great a risk. The VR is light perception and VL is hand movement.

b. A.G., male, born 1935 (No.Pr. 37032). At the age of 6 to 7 the patient was affected with an atypical Still's disease. One year later his vision was severely handicapped. A preparatory iridectomy was performed after a chronic iridocyclitis had been active for 10 years. The vision in both eyes was light perception in 1953.

2. There were 14 patients with chronic uveitis of both eyes. Grouping these etiologically 5 cases were of tuberculosis origin, 2 were rheumatic uveitis and 7 were of unclassified nature. The two cases of rheumatic uveitis were young men in their twenties when the disease first developed. The seven cases of unclassified uveitis were all in an advanced stage when first admitted for treatment.

The following tables give a short summary of the onset, sex, etiology and the remaining visual function of the cases involved.

<u>Age of onset</u>	<u>Sex</u>		<u>Etiology</u>		
	<u>Male</u>	<u>Female</u>	<u>Rheumatic</u>	<u>Tuberculosis</u>	<u>Unclassified</u>
20-30 4	3	1	2	1	1
31-50 5		5		3	2
51-60 1		1			1
61 and above 4	2	2		1	3

<u>Visual Function</u>	<u>Eyes</u>	<u>(Aphacic eyes)</u>
Enucleated	2	1
Phthisis	6	3
Under 1/100	10	-
1/100	4	2
1/60	4	1
2/60	2	1

Conditions causing blindness in the individual eyes

	<u>No. of patients</u>	<u>Eyes</u>	<u>Remarks</u>
Complicated cataracts, operated on	7	8	3 developed secondary glaucomas
Complicated cataract, not operated on	5	7	3 developed secondary glaucomas
Secondary glaucomas, directly following the uveitis	8	9	
Exsudative detachment of the retina, not operated on	2	2	
Phthisis, directly following uveitis	2	2	

Seven patients were operated on for complicated cataracts. Of these, six were operated on in only one eye. (The visual results are noted in the above table.) Post-operative three cases became phthisic, and the other three developed secondary glaucomas with exsudation and corneal dystrophy accompanying two of these cases. One patient was operated on for a complicated cataract in both eyes. The first eye was enucleated due to phthisis following the operation, and the other eye displayed a vision of 2/60, which was an improvement.

Five patients with complicated cataracts were not operated on. Three of these patients demonstrated a complicated cataract in only one eye; one developed a secondary glaucoma, the second became blind, and the third patient's vision remained at 1/60 with the cataract. The other two patients had cataracts in both eyes, the one patient's cataracts were not operable because of the prognostic result of the diagnostic

puncture of the anterior chamber and a secondary glaucoma developed in the other patient's eyes.

Reasons for not extracting the complicated cataracts

No. of eyes

1	Poor general physical condition
2	Poor light perception
3	Uncontrollable secondary glaucoma (despite an iridectomy)
2	Poor prognostic result of the diagnostic puncture of the anterior chamber

In the cases where one complicated cataract was operated on, and in the cases of complicated cataracts of both eyes which were not operated upon, further operative procedures were considered too risky in view of the result of the diagnostic puncture of the anterior chamber. The diagnostic puncture of the anterior chamber provides an excellent guide for the prognosis for an extraction of a complicated cataract following uveitis (Böhringer & Verrey).

Of all 14 patients, six demonstrated a secondary glaucoma in both eyes and three in one eye. By 8 patients, 9 eyes developed a secondary glaucoma directly following the uveitis. Two of these eyes became phthisic, six displayed a vision of hand movement or light perception and one eye's vision was 1/60, although this was partially due to a corneal dystrophy. Three eyes developed a secondary glaucoma following an extraction of a complicated cataract and three eyes with unoperated complicated cataracts were further complicated by the presence of a secondary glaucoma. The cases concerning complicated cataracts and secondary glaucoma are referred to in the above paragraphs.

C. INFECTIOUS RETINOVASCULAR DISEASES

1. Typical tuberculous periphlebitis

Of the two cases, one was tuberculosis and the other was of unclear etiology although it was treated as tuberculosis. Both cases were young men, 25 and 23 years old, at the onset of the disease, and both developed a secondary glaucoma in one eye.

a. E.V., male, born 1920 (No. 676). In 1945 a periphlebitis developed in both eyes. The right eye became amaurotic after demonstrating retinal and vitreous body hemorrhages and in 1950 proliferation bands and a retinal detachment reduced the vision to 1/60. The etiology most probably was not tuberculosis. Further therapy is considered useless.

b. J.R., male, born 1929 (No. 4132). A secondary glaucoma developed after a hemorrhage of the retinal veins of the right eye in 1952. Bands of proliferation and a probable retinal detachment reduced the sight in the left eye to 2/60 in 1952. The etiology was tuberculosis with an active renal tuberculosis. There is nothing more therapeutically that can be done.

2. Septic obstruction of the branches of the retinal arteries. The three cases demonstrated a variety of pathogenesis, and how violent septic embolic conditions can run their course. All three cases had developed secondary glaucomas with rubeosis iridis. Two patients died within three months after becoming blind. In the remaining case, no definite etiological factor has been discovered although periphlebitis or diabetic retinopathy were proposed.

a. J.C., male, born 1908 (No. 3911). The etiology of this case has not been determined. Retinal and vitreous body hemorrhages followed by a secondary glaucoma in both eyes reduced the vision to hand movement in the right eye and 2/60 in the left eye.

b. E.R., female, born 1904 (No. 4191). A retinal hemorrhage and exsudative detachment of the retina with a secondary glaucoma produced total blindness within a short period of time. Three months after being blind the patient died at the age of 46 due to a macroglobulinaemia Waldenström.

c. E.M., male, born 1915 (No. 4548). In the summer of 1951 the patient was hospitalized with endocarditis. Localized septic retinal-arterial infections and secondary glaucoma led to a vision of hand movement in the right eye and 2/60 in the left eye. Despite concentrated antibiotic therapy the patient died. The entire process developed over a period of six months, the patient being blind the last two months.

III. METABOLIC AND DEGENERATIVE PROCESSES

A. DIABETIC RETINOPATHY AND COMPLICATIONS

Of the eleven cases of diabetic retinopathy, nine cases were adult diabetes and two were juvenile diabetes. All cases, with the exception of one juvenile diabetes, were female. Three adult cases and one juvenile case were proven to have diabetic glomerulosclerosis.

A severe retinopathy with hemorrhages of the vitreous body and proliferation bands was present in nine cases. Eight patients developed secondary glaucomas with rubeosis iridis, seven in one eye and one in both eyes. In the last case, it was necessary to enucleate one eye.

Senile cataracts further complicated five cases. Two patients were operated on in one eye and secondary hemorrhagic glaucomas ensued. The remaining cataracts were not operated on due to the local and general physical condition.

The age at which the patients became blind were widely grouped. (See the following table.)

<u>Age</u>	<u>No. of patients</u>
20-30	2
40-50	2
51-60	2
61-71	5

Three of the nine adult cases and one of the juvenile cases have succumbed, all within 1-2 years after becoming blind.

B. ARTERIOSCLEROSIS

1. Arteriosclerotic retinopathy

Varying degrees and forms of fundus alterations were demonstrated in all three cases. No unified clinical picture could describe a definitely typical process.

Secondary glaucomas, in one eye of one patient and in both eyes of another patient, were discovered.

Local and general medical treatment was fruitless in all cases.

Two patients were female, aged 70 and 64, and the male patient was 79 when they became blind.

a. E.J., female, born 1877 (No. 652). It was discovered that the patient had a blood pressure of 190/110 mm Hg. With a retroretinal hemorrhage and vitreous body hemorrhages, both eyes became amaurotic.

b. L.H., female, born 1884 (No. 1777). Since 1945 the patient demonstrated a hypertonic fundus with a blood pressure of 205/115 mm Hg. A chronic iridocyclitis further complicated the clinical picture. Both eyes became amaurotic due to a secondary glaucoma with rubeosis iridis in 1948.

c. K.S., male, born 1871 (No. 2644). An absolute glaucoma with rubreosis iridis, eventually after a thrombosis of the central vein, yielded the right eye amaurotic. The vision of the left eye was reduced to less than 1/100 following a vitreous body hemorrhage, macular degeneration and a senile cataract. It was deemed unwise to extract the cataract due to the physical condition of the patient.

2. Obstruction of the central retinal artery in both eyes

The first case, K.G., male, born 1876 (No. 779), became totally amaurotic by obstructions of the central arteries within two weeks following the loss of sight in the first eye. Physical examination revealed a universal arteriosclerosis.

The second case, F.M., female, born 1886 (No. 1579), became blind in the right eye in 1937. Ten years later, an obstruction of the left central retinal artery led to total blindness. When examined, a blood pressure of 270/130 mm Hg was revealed.

3. Thrombosis of the central retinal vein

Case C.B., female, born 1890 (No. 3109), actually had two factors leading to total amaurosis. An absolute glaucoma, untreated, made it necessary to enucleate the left eye. The right eye showed a chronic glaucoma which was compensated for 12 years after a cyclodiathermy operation was performed. In 1953 a central retinal vein thrombosis followed by secondary glaucoma left the eye amaurotic.

4. Arteriosclerotic atrophy of the optic nerve

The four cases displayed the clinical picture of arteriosclerotic papillitis. One patient was 51 years old, the other three being 71, 76 and 79 years old when they lost their sight. Three patients were female, the male being the oldest.

Two patients rapidly became amaurotic. A simple atrophy of the optic nerve was noted in the other two cases.

5. Cerebral arteriosclerosis

The two cases were of opposite polarity when the course of blindness was considered. One case was the direct result of an arteriosclerotic apoplectic insult, but the other was shrouded with a prior history of glaucoma. The fact that the vision suddenly was lost, by the patient with the glaucoma, led to the diagnosis of a sclerotic apoplectic insult.

a. B.M., female, born 1880 (No. 2642). In 1948 the patient had a blood pressure of 215/115 mm Hg with a universal arteriosclerosis. Following a colpenceleisis, a bilateral cerebral apoplectic amaurosis set in.

b. O.K., male, born 1871 (No. 2753). Before 1940 the patient was receiving treatment for a simple chronic glaucoma. In 1946 the right eye developed an absolute glaucoma and the vision of the left eye was 0.5. In 1948 an apoplectic insult reduced the vision to total amaurosis.

C. ATROPHY OF THE OPTIC NERVE

Of the four cases, three were unclassified and one was attributed to arachnoiditis opticochiasmatica. The patients were male, between the ages of 37 to 45, and one was a young girl of 3 years when the blindness set in.

a. R.F., male, born 1907 (No. 785). After convalescing from enterocolitis the vision gradually decreased. An operation for arachnoiditis opticochiasmatica confirmed the diagnosis. The vision remained at 1/2/60 for both eyes.

b. R.W., female, born 1946 (No. 3065). A diagnosis of simple atrophy of the optic nerve was established in 1949, but all efforts to uncover the etiology were fruitless. There is "practically" no vision to date.

c. W.G., male, born 1914 (No.4363). A general decrease of vision in both eyes prompted the proposed diagnosis of arachnoiditis opticochiasmatica. An operation did not confirm the diagnosis. The visions remained at 1/60 for both eyes and the patient committed suicide in 1951.

d. E.Z., male, born 1904 (No.4713). While atrophy of the optic nerves was diagnosed, no etiological factor could be determined and the vision remained at 2/60 in both eyes.

D. CATARACT

1. Presenile cataract (myopic?)

The history of one case is very unclear whereas the other two are of a classical nature. All cases were male, the first case was 73 years old and the others 30 and 32 years old when they became blind. Two factors, uveitis with a secondary glaucoma and a black cataract, caused blindness in the first case. In the second and third cases, the cataracts caused the loss of sight, but on attempt to remove the lenses in each case a secondary hemorrhage precluded further therapy. A secondary glaucoma was noted in one eye of two patients.

a. E.K., male, born 1874 (No.1734). An operation for myopia was performed on both eyes in 1903. Iridocyclitis, disseminating choroiditis with a secondary glaucoma necessitated the enucleation of the left eye in 1947. Due to iridophacodonesis and poor light projection, the right eye was not given further treatment and a vision of hand movement remained.

b. G.D., male, born 1921 (No. 2146). In 1947 the patient demonstrated a presenile cataract by myopia of a light grade in both eyes. A post operative hemorrhage with a secondary glaucoma followed an extraction of the right lens. Although the vision temporarily improved, in 1951 the vision was hand movement in the right eye and light perception in the left eye.

c. R.M., male, born 1920 (No.4596). In 1954 presenile cataracts of both eyes by a myopia of light grade had left the left eye amaurotic. After extracting the right lens a rubeosis iridis with a beginning phthisis bulbi ensued. In 1952 the vision in the right eye was light perception.

2. Post operative complications of senile cataracts

All cases ran different courses which led to blindness. The patients were elderly men 82, 68 and 82 years old respectively. The first patient succumbed one year after becoming blind.

The first patient, A.W., male, born 1863 (No.57), demonstrated a blood pressure of 220/100 mm Hg. After a post operative expulsive hemorrhage of the first eye, every possible caution, including a preparatory iridectomy, did not forestall an expulsive hemorrhage during the operation on the second eye. One eye became phthisic and the other needed to be enucleated.

The second patient, J.S., male, born 1877 (No.91), developed a sympathetic ophthalmia and secondary glaucoma after an extraction of a cataract, necessitating the enucleation of the operated eye. The sympathetic ophthalmia of the other eye ran a severe course and after an iridectomy the vision became worse and remained at poor light perception.

The third patient, H.P., male, born 1868 (No.4032), developed a post operative corneal dystrophy after the removal of both cataracts. Vision was hand movement in the right eye and 2/60 in the left eye in 1950.

E. MYOPIC DEGENERATION OF THE RETINA

The patient, H.K., male, born 1898 (No.115) demonstrated a large myopia with a complicated cataract in the right eye and an aphacic left eye, after extraction of a congenital cataract. With retinochorioid myopic degeneration in both eyes, further therapy was deemed valueless. The vision was hand movement in the right eye and 1/60 in the left eye.

F. DETACHMENT OF THE RETINA

There were 13 patients with "idiopathic", four patients with aphacic, and four patients with retinal detachments due to trauma. The traumatic retinal detachments were attributed to three contusions and one perforation. (See section on injuries to the eye.)

1. The so called idiopathic retinal detachments

The idiopathic retinal detachments were grouped according to their refraction. (See the following table.)

<u>Refraction</u>	<u>No. of Cases</u>
Emmetropia to myopia of 5 diopters	1
Myopia of 5 to 10 diopters	1
Myopia of 11 to 20 diopters	8
more than minus 20 diopters	1
unknown	2

Five patients were male and eight were female.

A survey of the ages at which the second eye became blind is as follows:

<u>Age</u>	<u>No. of patients</u>
29-40 years	3
41-50 years	4
51-60 years	4
61 years and above	2

Ten (probably 12) patients became blind in both eyes due to detachment of the retina.

The interval of time between the loss of sight in the first eye and the blinding of the second eye was divided as follows:

<u>Years</u>	<u>No. of patients</u>
Less than 1 year	1
1 year	1
4 years	1
6 to 9 years	3
10 to 13 years	4

By one patient, a myopic macular degeneration blinded one eye, and the other eye, although blind due to a retinal detachment, was enucleated when it became hypotensive after uveitis. Two patients had probable detachments in the first eye, but these were not medically determined.

Six patients were not operated on in the first eye, four because the condition had existed too long, and two because the detachment arose before the era of operative therapy.

Out of 12 patients, 17 eyes were operated on.

<u>No. of operations</u>	<u>No. of eyes</u>
1	7
2	5
3	3
4	1
9	1

Either surface diathermia or catholysis was used in the operations. No lamellar or total scleral resections were performed. All cases showed no post operative improvement. After a cataract operation was performed the vision in one case was stabilized.

2. Aphacic detachment of the retina

The aphacias were after a Fukula operation (myopia), a zonular cataract, pre-senile cataract, and a complicated cataract from a hydrophthalmos.

Three patients were male and one female. At the time the patients were blinded they were 50, 47, 37 and 11 years old.

a. B.S., female, born 1902 (No. 2093). In 1918 the congenital zonular cataracts were operated on. In 1920 the right eye developed a retinal detachment, and it was necessary to enucleate the eye in 1938. The left eye developed a retinal detachment in 1930 and after performing two operations in 1935/36 the detachment was stationary with a limited visual function. After a relapse in 1951 a lamellar scleral resection was performed but a secondary glaucoma reduced the vision to hand movement and the eye had to be enucleated.

b. J.S., male, born 1902 (No.3443). The left eye had been phthisic since childhood, but no cause could be determined. Following the extraction of the pre-senile cataract of the right eye in 1947, a retinal detachment ensued in 1949. The vision remained at hand movement after three unsuccessful operations.

c. P.F., male, born 1916 (No.3956). A Fukula operation was performed on both eyes for myopia in 1931. After a trauma in 1936 a retinal detachment left the left eye amaurotic, and one operation was unsuccessful. A detachment with a horseshoe tear developed in 1951 in the right eye, but it was difficult to see due to an after cataract. An operation was unsuccessful and the vision remained at hand movement.

d. J.L., male, born 1942 (No.5303). A hydrophthalmos of both eyes was treated with an iridencleisis and trephining in both eyes. The right eye was amaurotic. In the left eye a cataract developed and a discission was performed with success in 1949, yielding a vision of 0,1. In 1952 a retinal detachment with disinsertion of the ora had to be operated on, without success.

3. Four cases of traumatic detachment of the retina are noted in the section on injuries to the eye.

G. CHRONIC GLAUCOMA

1. Simple glaucoma

Of the 16 patients within this group, nine were women. The glaucoma had its onset when one patient was 42 years old, six were between the ages of 51 and 60, eight were between 61 to 70, and one was 71. Nine patients became blind between 63 and 70 years of age, seven between 71 and 77 years. One had been receiving treatment for 35 years before he became blind, while another became blind within the same year that the glaucoma was diagnosed. Seven patients were blind within 1 to 5 years, three within 6 to 10 years and four within 11 to 16 years after the diagnosis was established. Two patients have succumbed.

All but one case concerned both eyes. This one became blind in one eye through thrombosis of the central vein followed by a secondary glaucoma.

Five patients became blind on one or both eyes possibly due to their own neglect.

The case of H.W., male, born 1873 (No.1242), is a good example. In 1944, a glaucoma in both eyes was diagnosed and conservative therapy with regular visits was prescribed. One year lapsed without the therapy or control. Both eyes demonstrated a semi absolute glaucoma upon entry into the clinic. Trephining was performed on both eyes, controlling the tension, but the vision was light perception in both eyes in 1946. It is quite possible that the physician did not follow this case closely enough.

An absolute or almost absolute glaucoma was discovered in both eyes of three patients and in one eye of eight patients upon first examination. The three patients, with both eyes in this condition, can be partially blamed for personal neglect or, as in the above case, possibly the physician was partially to blame.

It is hoped that through the expansion of the clinic and the establishment of a special "glaucoma" clinic, that the control of the patients will be improved.

Six patients lost their vision in one eye, even though the tension was regulated. Five of these cases were after operations had been performed; one after cyclodiathermy,

one after cyclodialysis, one after cyclodialysis, but with a probable central (cerebral) amaurosis, and two after an Elliot trephining. One patient simply lost the vision in one eye while under treatment whereas a seventh patient lost the sight in both eyes under the same circumstances. Of the seven patients, four had lost the sight in the other eye previously, due to either an absolute or semi absolute glaucoma.

Uncontrollable increase in the tension blinded three patients. The first patient became blind in both eyes even though an iridencleisis and cyclodialysis had been performed on both eyes. The second patient was blind in one eye due to an absolute glaucoma and further therapy was not undertaken on the other eye, at the request of the patient. A total amaurosis is the result. The third patient was blind in one eye although the tension was compensated by a trephine, but the second eye became blind after the patient neglected the conservative therapy.

There were five cases of postoperative complications. A corneal dystrophy after the extraction of a cataract caused the loss of sight in one eye of two patients. One of these patients was blind in the other eye due to an absolute glaucoma, the second patient having lost the vision in the other eye while under regularly controlled conservative therapy. Secondary infections following an Elliot's trephining caused the loss of sight in one eye of another two patients. Both of these patients had demonstrated an absolute glaucoma in the other eye. One infection arose 14 months after the trephining, and the other, a creeping uveitis, developed 7 months after the operation.

2. Chronic inflammatory (congestive) glaucoma

Five women and one man compile the cases of chronic inflammatory glaucoma. The man was 52 years old when blinded, the remaining cases were 65 years old and older, the oldest 82 years when they became sightless. One patient has succumbed.

With the exception of one patient, all cases of chronic inflammatory glaucoma were in both eyes. This patient lost one eye through a calcium hydrate burn. Panophthalmia necessitated the enucleation of this eye.

The same patient became amaurotic despite an iridectomy and two cyclodiathermy operations on his only eye. Uncontrollable tension effected blindness in both eyes of another case although iridectomies had been performed.

A patient's eye was enucleated after conservative and operative therapy did not control the increased tension. The other eye became blind after a corneal dystrophy followed an iridectomy. A lamellar keratoplasty became dystrophic and the vision decreased to less than 1/100. Dystrophic corneas after iridectomies developed in both eyes of another individual. A perforating corneal graft was performed but a

severe post-operative hypertension made it necessary to enucleate the eye. After extraction of the complicated cataracts in a compensated glaucoma, corneal dystrophy developed in both eyes and left another patient blind.

The sixth patient already demonstrated an absolute glaucoma of one eye when she was admitted to the clinic. It was necessary to enucleate this eye, and the other eye showed a normal tension after an iridectomy but the vision decreased to hand movement.

H. SECONDARY GLAUCOMA

The origins of the two cases were extremely different. The first patient was originally "practically" blind. Operations on congenital cataracts were performed at the age of two. Thirty nine years later a secondary glaucoma terminated what vision was left. The second patient has never had a "normal" vision due to retinitis pigmentosa, but became totally amaurotic due to a secondary glaucoma.

a. M. L., female, born 1905 (No. 1893). After an operation for congenital cataracts at the age of 2, an after cataract was operated on in the right eye in 1917. A keratitis developed in both eyes in 1938 and 1941. A cyclodiathermy was performed on the right eye after a secondary glaucoma arose in both eyes. The tension was controlled but the vision remained at light perception in 1946.

b. A. D., male, born 1913 (No. 2853). The patient was discovered to have retinitis pigmentosa. In 1948, a secondary glaucoma reduced the vision to total amaurosis.

Other cases of secondary glaucoma were discussed in earlier sections as listed below:

<u>Section</u>	<u>No. of patients</u>	<u>One eye</u>	<u>Both eyes</u>
Chemical burns	3	1	2
Contusion of the eyeball	1	1	-
Keratitis	4	2	2
Chronic uveitis	9	3	6
Infectious retino-vascular diseases	2	2	-
Septic-embolic obstruction	3	-	3
Diabetic retinopathy	7	6	1
Arteriosclerotic retinopathy	2	1	1
Thrombosis of the central retinal vein	1	1	-
Post operative complications of senile cataracts	1	1	-
Aphacic retinal detachment	1	1	-
Chronic congestive glaucoma (central vein thrombosis!)	1	1	-
	35	20	15

IV. TUMORS

A. RETINOBLASTOMA

The patient, I.H., female, born 1948 (No.3624), was discovered to have retinoblastomas in both eyes. The eyes were enucleated in 1950.

B. BRAIN TUMORS

Two patients were known to have been operated on, but there is no further information on the third patient. Although aided by an operation, one case became amaurotic after a re-exploration for recidivation. The tumors were as follows: meningioma, malignant glioblastoma, and one unknown.

Two patients were women, 52 and 21 years old, the man 35 years old, when they became blind. One patient died 3 years, the other 2 years after becoming blind.

a. H.S., female, born 1896 (No.2334). An atrophy of the optic nerve in both eyes was discovered in 1948, and an operation confirmed the diagnosis of meningioma in the left parietal region. The vision remained at less than 1/100. The patient died in 1951 of pneumococcus meningitis.

b. W.P., male, born 1912 (No.2348). With atrophy of both optic nerves, the patient was operated on for a glioblastoma. Post operative, the vision improved to 0.1. After a re-exploration for recidivation in 1947, a total amaurosis set in and two years later the patient died.

c. M.W., female, born 1930 (No.4678). With a vision of 1/60 in the right eye, 2/60 in the left eye, and a diagnosis of a frontobasal brain tumor, the patient was not operated on at the request of the family, and was released from the clinic. No further information about the patient has been received.

In concluding this article, several features are of outstanding interest.

After reviewing the cases, it was noticed that 14 patients lost one eye due to some other cause than that which led to blindness. (See the following table.)

No. of patients	Etiological causes of blindness	
	of first eye	of second eye
5	Trauma	Contusion of the eyeball
	3 perforations	
	2 contusions with	
	retinal detachment	
1	Trauma	herpetic keratitis
1	Trauma	chronic inflammatory glaucoma
1	absolute glaucoma	chronic uveitis
1	absolute glaucoma	creeping ulcerative keratitis
1	absolute glaucoma	arteriosclerotic retinopathy
1	absolute glaucoma	thrombosis of the central retinal vein
1	absolute glaucoma	cerebral arteriosclerosis
1	secondary glaucoma	zonular cataract
	(after uveitis)	
1	secondary glaucoma	chronic congestive glaucoma
	after central vein	
	thrombosis	

It was interesting that no case represented in this survey were primarily blind in one eye due to amblyopia (squint etc.).

Aside from the two cases which became blind from a secondary glaucoma, 35 additional cases demonstrated a secondary glaucoma in either one or both eyes. See section on secondary glaucoma.

The ages at which the patients became blind are varied, but it should be noted that 92 individuals were between 40 and 80 years old. (See the following table).

<u>Age</u>	<u>No. of patients</u>
0-10 years	3 (Retinoblastoma and Still's disease)
11-20 years	2
21-30 years	10
31-40 years	12
41-50 years	20
51-60 years	19
61-70 years	31
71-80 years	22
81 years and over	3
Total	122

The sexes were unevenly divided, 66 males and 56 females. Males were predominately effected by injuries, whereas females dominated the glaucoma section. The sexes were more evenly distributed in the sections on infectious and degenerative processes. (See the following table.)

<u>Group</u>	<u>No. of patients</u>	<u>Male</u>	<u>Female</u>
I. Injuries	15	14	1
II. Infections	28	17	11
III. Metabolic and degenerative processes	75	34	41
IV. Tumors	4	1	3
	122	66	56

Summary

This article concerns the 122 cases of non-congenital blindness admitted in the University of Zürich Ophthalmological Clinic from 1945 to June 1953.

The various cases were grouped into four main categories, injuries, infections, metabolic and degenerative processes, and tumors.

In each group a general discussion of the etiology, complications, therapy, preventive measures, age and general prognosis were related wherever applicable.

The major causes for blindness are listed below according to their frequency.

1. Glaucoma	22
2. Detachment of the retina	17
3. Chronic uveitis	16
4. Injuries	15
5. Diabetic retinopathy	11

The remaining 41 cases are compiled
among the other etiological groups

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Curriculum Vitae

I was born in Fresno California on 26 July 1924. After completing my primary and secondary schooling in Fresno California I entered the University of California at Berkeley to begin my premedical studies in 1942. Called to active duty in the United States Navy from 1944 to 1946, I returned to complete my Bachelor of Arts degree at the University of California at Berkeley in 1947.

While waiting for the opportunity to enter medical school I worked at the Cutter Laboratories as director of the media department and in 1948 I entered the University of Zurich to further my medical studies.

